SEQUENCE LISTING

<110> Tomb, Jean-Francois
      Bramucci, Michael G.
      Cheng, Qiong
      Kostichka, Kristy N.

<120> Rhodococcus Cloning and Expression Vectors

<130> CL1709 US NA

<150> 60/254,868
<151> 2000-12-12

<160> 30

<170> Microsoft Office 97

<210> 1

<211> 1140

<212> DNA

<213> Rhodococcus AN12

<400> 1
atgaccagcg taagtgctga acacctttcc ggcaaagacc ggcctcccgt cctcgtgtcg   60

tccgataagc gcggcatccg gcacgaactg cgacccaaac ttcaacaaat caccacgtca   120

gaaacattta acgcctgtgg ccggccgatt tctggcgtga acggtgtgac cattgtcaac   180

ggtccgaaag gttctggatt cggaggcctt cgttcctgcg gaaagggctg gatctgcccc   240

tgctgtgcgg gaaaagtcgg tgcacatcgt gcagacgaaa tttctcaagt tgttgctcat   300

caactcggga ctggatctgt tgcgatggtg acgatgacca tgcgccatac agctggtcag   360

cggctccacg acctatggac tggactttcg gcagcctgga aagctgcgac caacggtcgt   420

cgttggcgta cggaacgtga aatgtacggc tgcgacggat acgtgcgcgc tgttgaaatc   480

actcacggaa aaaacggctg gcacgtccac gttcacgcgc tactcatgtt cagtggtgac   540

gtgagtgaga acatcctcga atccttctcg gatgcgatgt cgatcggtg gacttccaaa   600

ctcgtatctc tgggatttgc tgcgccacta cgtaattcgg gtggtctcga tgtacgaaag   660

atcggcggtg aagctgatca agttctcgct gcgtatctga cgaaaattgc atctggcgtt   720

ggtatggagg ttggtagtgg cgacggaaaa agtggtcgac atggcaaccg tgcaccctgg   780

gaaatcgctg ttgatgcagt gggcggggat ccacaagcgt tggaactgtg gcgagaattt   840

```
gagtttggtt cgatgggacg tcgggcaatc gcgtggtccc gtggattgcg tgcccgagct    900

ggtcttgggg cagaactaac agatgctcag atcgttgagc aggaagaatc tgccccggtc    960

atggttgcga tcattccggc gcgatcgtgg atgatgattc ggacttgtgc gccttacgtc    1020

ttcggcgaga tcctcggact cgtcgaagct ggcgcgactt gggaaaatct tcgtgatcac .  1080

ttgcattatc gattgcccgc agcggatgtg cggcccccga taatatcggt tcgcaagtga    1140
```

<210> 2

<211> 379

<212> PRT

<213> Rhodococcus AN12

<400> 2

```
Met Thr Ser Val Ser Ala Glu His Leu Ser Gly Lys Asp Arg Pro Pro
1               5                  10                  15

Val Leu Val Ser Ser Asp Lys Arg Gly Ile Arg His Glu Leu Arg Pro
            20                  25                  30

Lys Leu Gln Gln Ile Thr Thr Ser Glu Thr Phe Asn Ala Cys Gly Arg
        35                  40                  45

Pro Ile Ser Gly Val Asn Gly Val Thr Ile Val Asn Gly Pro Lys Gly
    50                  55                  60

Ser Gly Phe Gly Gly Leu Arg Ser Cys Gly Lys Gly Trp Ile Cys Pro
65                  70                  75                  80

Cys Cys Ala Gly Lys Val Gly Ala His Arg Ala Asp Glu Ile Ser Gln
                85                  90                  95

Val Val Ala His Gln Leu Gly Thr Gly Ser Val Ala Met Val Thr Met
            100                 105                 110

Thr Met Arg His Thr Ala Gly Gln Arg Leu His Asp Leu Trp Thr Gly
            115                 120                 125

Leu Ser Ala Ala Trp Lys Ala Ala Thr Asn Gly Arg Arg Trp Arg Thr
    130                 135                 140

Glu Arg Glu Met Tyr Gly Cys Asp Gly Tyr Val Arg Ala Val Glu Ile
145                 150                 155                 160
```
```
                                      2
```

```
Thr His Gly Lys Asn Gly Trp His Val His Val His Ala Leu Leu Met
            165             170             175

Phe Ser Gly Asp Val Ser Glu Asn Ile Leu Glu Ser Phe Ser Asp Ala
            180             185             190

Met Phe Asp Arg Trp Thr Ser Lys Leu Val Ser Leu Gly Phe Ala Ala
            195             200             205

Pro Leu Arg Asn Ser Gly Gly Leu Asp Val Arg Lys Ile Gly Gly Glu
    210             215             220

Ala Asp Gln Val Leu Ala Ala Tyr Leu Thr Lys Ile Ala Ser Gly Val
225             230             235             240

Gly Met Glu Val Gly Ser Gly Asp Gly Lys Ser Gly Arg His Gly Asn
            245             250             255

Arg Ala Pro Trp Glu Ile Ala Val Asp Ala Val Gly Gly Asp Pro Gln
            260             265             270

Ala Leu Glu Leu Trp Arg Glu Phe Glu Phe Gly Ser Met Gly Arg Arg
            275             280             285

Ala Ile Ala Trp Ser Arg Gly Leu Arg Ala Arg Ala Gly Leu Gly Ala
    290             295             300

Glu Leu Thr Asp Ala Gln Ile Val Glu Gln Glu Glu Ser Ala Pro Val
305             310             315             320

Met Val Ala Ile Ile Pro Ala Arg Ser Trp Met Met Ile Arg Thr Cys
            325             330             335

Ala Pro Tyr Val Phe Gly Glu Ile Leu Gly Leu Val Glu Ala Gly Ala
            340             345             350

Thr Trp Glu Asn Leu Arg Asp His Leu His Tyr Arg Leu Pro Ala Ala
            355             360             365

Asp Val Arg Pro Pro Ile Ile Ser Val Arg Lys
    370             375
```

<210> 3

<211> 891

<212> DNA

<213> Rhodococcus AN12

3

<400> 3
```
atggatcaaa cagacacgat cccgattgcg attggatgga cgaactagc tcaacctgtc      60
atggtcgata tagccaaaga tgctgctcac tggctcattc aaggcaaaac ccgttccgga     120
aaatctcaat gcacctacaa cctgctcgca caggctggat cgaatcccgc tgtgcgtgtc     180
gtcggagtcg atcccacttc cgtcttacta gccccattcg tccaccgacg accggctgaa     240
ccgaacatcg agctcgggct gaacgatttt gacaaagtcc tccgagtgct ccagttcgtc     300
aaagcagaat ctgaccgacg aatcgagtgt ttctgggatc gacgcataga caaaatttcg     360
ttgttctcgc cagcactacc tctcatcctg ctcgtactgg aagaatttcc cggaatcatc     420
gagggcgcac aggatttcga tgcaaccaac ggtctgaaac cagcagacag atacgcaccc     480
cgcatcacat cgcttgttcg acagatcgct gctcagtctg ccaaagcagg catcagaatg     540
ttgctcttgg ctcaacgtgc ggaagcttcc atcgtgggtg aaacgcccg ctcgaacttc      600
gcggtgaaaa tgactctccg cgtagacgaa cctgaatctg tcaaaatgct gcaccccaac     660
gcaacacctg aagagtgcgc actggtcgaa ggattcgtcc ctggtcaagg cttcttcgac     720
caacccggac tacggcgcca atgatccga acggttcgcg taggtgagta ctcgacctac      780
gcgagttacg tcgaaaacgc agacctcgcg tacgaagccg cactgaacat cgaccgagca     840
caacgaatga caatcgcctc ggaataccca catctcggcg acataggctg a             891
```

<210> 4

<211> 296

<212> PRT

<213> Rhodococcus AN12

<400> 4

```
Met Asp Gln Thr Asp Thr Ile Pro Ile Ala Ile Gly Trp Asn Glu Leu
1               5                  10                  15

Ala Gln Pro Val Met Val Asp Ile Ala Lys Asp Ala Ala His Trp Leu
            20                  25                  30

Ile Gln Gly Lys Thr Arg Ser Gly Lys Ser Gln Cys Thr Tyr Asn Leu
        35                  40                  45

Leu Ala Gln Ala Gly Ser Asn Pro Ala Val Arg Val Val Gly Val Asp
    50                  55                  60

Pro Thr Ser Val Leu Leu Ala Pro Phe Val His Arg Arg Pro Ala Glu
65                  70                  75                  80
```

4

Pro Asn Ile Glu Leu Gly Leu Asn Asp Phe Asp Lys Val Leu Arg Val
                85   90   95

Leu Gln Phe Val Lys Ala Glu Ser Asp Arg Arg Ile Glu Cys Phe Trp
            100   105   110

Asp Arg Arg Ile Asp Lys Ile Ser Leu Phe Ser Pro Ala Leu Pro Leu
        115   120   125

Ile Leu Leu Val Leu Glu Glu Phe Pro Gly Ile Ile Glu Gly Ala Gln
    130   135   140

Asp Phe Asp Ala Thr Asn Gly Leu Lys Pro Ala Asp Arg Tyr Ala Pro
145   150   155   160

Arg Ile Thr Ser Leu Val Arg Gln Ile Ala Ala Gln Ser Ala Lys Ala
            165   170   175

Gly Ile Arg Met Leu Leu Leu Ala Gln Arg Ala Glu Ala Ser Ile Val
            180   185   190

Gly Gly Asn Ala Arg Ser Asn Phe Ala Val Lys Met Thr Leu Arg Val
        195   200   205

Asp Glu Pro Glu Ser Val Lys Met Leu His Pro Asn Ala Thr Pro Glu
    210   215   220

Glu Cys Ala Leu Val Glu Gly Phe Val Pro Gly Gln Gly Phe Phe Asp
225   230   235   240

Gln Pro Gly Leu Arg Arg Gln Met Ile Arg Thr Val Arg Val Gly Glu
            245   250   255

Tyr Ser Thr Tyr Ala Ser Tyr Val Glu Asn Ala Asp Leu Ala Tyr Glu
            260   265   270

Ala Ala Leu Asn Ile Asp Arg Ala Gln Arg Met Thr Ile Ala Ser Glu
        275   280   285

Tyr Pro His Leu Gly Asp Ile Gly
    290   295

<210>   5

<211>   6334

<212> DNA

<213> Rhodococcus AN12

<400> 5

```
attcagacca acaatcagtc caactagcaa ggcgacaacc ggtatcgcaa ttcgtgaaac      60

aagctttgtc atgcgtccgc gctcttacga gcaggtgcgg agacggccgc tgcaggcatt     120

ggaaccaaat tctccactgt gatggatagt gcgagacgat ccatgccagt catgtagggc     180

tgcacccaga caaggccttc tgctcggtag atcgtgccga agctgaacgg ctcgttcggc     240

gggttgatga cgtgcacgga tgctgtcttg tcagtcgcaa cagttccgtc cttgcgtgca     300

actcggagca atgcgccagt cgaatacttc acacggccgt cgggagtgag cttgtcctga     360

accggcttga tggggtcgtc cataccggct acgaacaccg gaactgatc agcggtagtt      420

gcgacgggga gggacgttcc gagctgaaca ttcatgcgag ttcctttgat cgaggctggt     480

acagcttatg tctccggtgt ccatattcag cgacacgcgt tcatctacac tcaaaaccgt    ·540

acacatagtg tagccagctg tccagttttc gcacactacg ttagcaactg aacatatttt     600

gtggttgatc agtcaataag ctgtccatat ggacgagaaa gaggttcgcg cgatgattca     660

gcgcaaagaa accgaacgaa aaatgcaggt catcaagcag gcgtccgtgg atctgtcaca     720

ctcctggcag accattcaga acgcgcacga ctccacgact gtcgcaatgg agctacgaga     780

agccgggctt caacgcgaat tctggctaca agctctcgcg gacatcacat ctgttgtggg     840

aactgcctct gagctgcgca atctatttc cgttttctc gttgacgagc ttgacgtcag       900

cagccgaacc gttgccaccg ttgcagatgt ttcaccgtcg accatcagta cttggcgtgg     960

tgagcatgag tcatcgtaaa aacatcctct gacctgctat ggccccaatg atcacctatt    1020

accaaggcgg cggcttcgcc gccgctgcca gcaggctccc ccacctacgc gctccgcttc    1080

gctcgcgctt cggtgctccg cccgcaggcc caggagcgag tttgcgcctc gtttagtcca    1140

tctaaggggt tcctagctgg cttgaggtcg caacgcatcc tgaagtcgat cgaggagcag    1200

gaacgcatca tctcgatcca gcgtggtttc ttgaccataa atcgagaggt acacgcccat    1260

gacaacgcca tcgacgtcta ccgaagctgg attcgctgcg atgccaagag gacgttcgtt    1320

gatgctcatg tgatgggttt acctgcaaaa atagtcagca gccaaatcgg aggcggcggc    1380

ttcgccgccg ctgccagcag gctcccccac ctacgcgctc gcttcgctc gcgcttcggt     1440

gctccgcccg caggcccagg agcgagtttg cgcctcgttt agtccatcta aggggttcct    1500

agctggcttg aggtcgcaac gcatcctgaa gtcgatcgag gagcaggaac gcatcatctc    1560

gatccagcgt ggtttcttga ccataaatcg agaggtacac gcccatgaca acgccatcga    1620

cgtctaccga agctggattc gctgcgatgc caagaggacg ttcgttgatg ctcatgtgat    1680

gggtttacct gcaaaaatag tcagcagcca aatcggccgg cctttttcta tctgcccggt    1740
```

6

```
cagcccccg agaccaacca tgaaacaggc cgtctctctg tcaaggccaa gccgctacgc      1800

ggtgctatcg cagccctgac agagagacac ccagcttcag agcggcaagt atcgggggga      1860

tgccctcaag tgtggttcat gcgggtgaaa gttgttgctc agcaacgctt ttcacttgcg      1920

aaccgatatt atcgggggcc gcacatccgc tgcgggcaat cgataatgca agtgatcacg      1980

aagattttcc caagtcgcgc cagcttcgac gagtccgagg atctcgccga agacgtaagg      2040

cgcacaagtc cgaatcatca tccacgatcg cgccggaatg atcgcaacca tgaccggggc      2100

agattcttcc tgctcaacga tctgagcatc tgttagttct gccccaagac cagctcgggc      2160

acgcaatcca cgggaccacg cgattgcccg acgtcccatc gaaccaaact caaattctcg      2220

ccacagttcc aacgcttgtg gatccccgcc cactgcatca acagcgattt cccagggtgc      2280

acggttgcca tgtcgaccac tttttccgtc gccactacca acctccatac caacgccaga      2340

tgcaattttc gtcagatacg cagcgagaac ttgatcagct tcaccgccga tctttcgtac      2400

atcgagacca cccgaattac gtagtggcgc agcaaatccc agagatacga gtttggaagt      2460

ccaccgatcg aacatcgcat ccgagaagga ttcgaggatg ttctcactca cgtcaccact      2520

gaacatgagt agcgcgtgaa cgtggacgtg ccagccgttt tttccgtgag tgatttcaac      2580

agcgcgcacg tatccgtcgc agccgtacat ttcacgttcc gtacgccaac gacgaccgtt      2640

ggtcgcagct ttccaggctg ccgaaagtcc agtccatagg tcgtggagcc gctgaccagc      2700

tgtatggcgc atggtcatcg tcaccatcgc aacagatcca gtcccgagtt gatgagcaac      2760

aacttgagaa atttcgtctg cacgatgtgc accgactttt cccgcacagc aggggcagat      2820

ccagcccttt ccgcaggaac gaaggcctcc gaatccagaa cctttcggac cgttgacaat      2880

ggtcacaccg ttcacgccag aaatcggccg gccacaggcg ttaaatgttt ctgacgtggt      2940

gatttgttga agtttgggtc gcagttcgtg ccggatgccg cgcttatcgg acgacacgag      3000

gacgggaggc cggtctttgc cggaaaggtg ttcagcactt acgctggtca taacgagcgg      3060

ggtcctagtc aagtaggagc ctcgaaggcg gcggcagggt ggtccaacac ccttcgtcgc      3120

cgctcgtatt ttcggagtaa atccagctag ttcagctcgg atactccact tcgaggttca      3180

tcgattattt ggtttttatc cacttaacca gcagaaacag cgtttatcgc tgatctgctg      3240

gtcagtgcgg cgtgtcgggg gagtcgctag tccgcggcga gtccccatgc ttcgagaaca      3300

ccgaccttct cttctggggt tctgcttgtc ttcaccagtg catcgaacag acctcggtat      3360

tcacccaagt gttcaatatc gaatccggct tccctggcgt aatcaggggt gtagtagcag      3420

cacatcgcag ccagaatctc ggacgattcg gcgcgttcac cagcatgaat ccaaccataa      3480

acgtcatgcc caccccatag atcaggccct cgatgatcgt aaatgccaac ggctagtcgg      3540

aggatgaata ccgtagcttc gtgcttcacg catcaaccct ctgatctgct gcactcagaa      3600

ttgcatgacc tcccgaatga ctgcataact cgtcgtagac ctgagcaacg aacgaaggcc      3660
```

7

```
gatcagcatt gtccatgaag agttggacga acttcggccg gacgaggcca atccacggcg      3720

cagtcaaagt ttcaaaatca tgtgcctcga ggtgctcatg cattgcaacc gcccatgcgg      3780

cccctcgagc ggcgcaccag tctcgttcaa ctccctcgct gtccgaaatg tcgtatttaa      3840

ggcccagtga tcgtccaact tcggcagctg cgtcactggc acgtttccaa tcgtcaccgc      3900

gtaagtcgtt gagctttccg agttcatcgc ctagaagcag ctcagacatt gcaaaaacgg      3960

tcatcgaact gacccatcgt ggaccgacta gtgcaccaag gtcgtcgtcg gtgatctgca      4020

tgccgcgaag ttcgtcgacg acagcttggc cttccaaacc tactctggcc ctgagtattt      4080

cagttattac gagatgatcg ttcggccagc ctgatttgat ccggagtgca gtcgttacga      4140

ctcgttccgt gggcaggttt cggcgtgagg cgagtttttc tcctgcctca tgtgcaacct      4200

tctcaaattg ctgtcgaatg taggtgttta ccgggattgc gtctgtcggg tagccgatca      4260

aggtgtgtcc tcctgtgtgt tcggttgtca gcctatgtcg ccgagatgtg ggtattccga      4320

ggcgattgtc attcgttgtg ctcggtcgat gttcagtgcg gcttcgtacg cgaggtctgc      4380

gttttcgacg taactcgcgt aggtcgagta ctcacctacg cgaaccgttc ggatcatttg      4440

gcgccgtagt ccgggttggt cgaagaagcc ttgaccaggg acgaatcctt cgaccagtgc      4500

gcactcttca ggtgttgcgt tggggtgcag cattttgaca gattcaggtt cgtctacgcg      4560

gagagtcatt ttcaccgcga agttcgagcg ggcgtttcca cccacgatgg aagcttccgc      4620

acgttgagcc aagagcaaca ttctgatgcc tgctttggca gactgagcag cgatctgtcg      4680

aacaagcgat gtgatgcggg gtgcgtatct gtctgctggt ttcagaccgt tggttgcatc      4740

gaaatcctgt cgccctcga tgattccggg aaattcttcc agtacgagca ggatgagagg      4800

tagtgctggc gagaacaacg aaattttgtc tatgcgtcga tcccagaaac actcgattcg      4860

tcggtcagat tctgctttga cgaactggag cactcggagg actttgtcaa aatcgttcag      4920

cccgagctcg atgttcggtt cagccggtcg tcggtggacg aatggggcta gtaagacgga      4980

agtgggatcg actccgacga cacgcacagc gggattcgat ccagcctgtg cgagcaggtt      5040

gtaggtgcat tgagattttc cggaacgggt tttgccttga atgagccagt gagcagcatc      5100

tttggctata tcgaccatga caggttgagc tagttcgttc catccaatcg caatcgggat      5160

cgtgtctgtt tgatccatca ggcgtccgtg cttttgtcga acggaagatc cttttcttgc      5220

tcccaccagg gccgattgtc cccgagtatg ccgccggcct cttccttcaa tgtgccggcc      5280

gatgagtcct cgacgtcact gagccatgct gcatctcgtg cttgagaaat ggtgtctgca      5340

tcgatcagaa gtagctcgac ccgacgcggc tctactttgg tgaaactggc acgtagagca      5400

ccgaaagcat cggctatttt gaccgtcttc gatgtcatat cttcaccggt gatccctgtc      5460

ggaaggtcga aagcgactga tcgagtcaat ccgtcgtccg aaaatttgta gctacgaatg      5520

atgggaggct gcccagagga gttgatcaga ccaagattgg ccgcagcacc tgcaacttcc      5580
```

8

```
ggggttcctc gccaccatcg agctgtacga cgtttgcgac gccgagcctt cgttgcctct    5640

ctcaggtaga ccattgccac aacgcacacc agcagcacac tgaccaaaag ccacatctga    5700

gcgtcgaaga tgtacagcag cagaagcaac agaaacgtag aggacagaat cgggtaatcg    5760

gcaatttttg ccttgagttt tgctcgcaaa atttgccagg tggaacgtct tttaacctgg    5820

tcaccgcgtc gaacggcttc gtagttgctc atcggggcca ctccacaacg acattcggac    5880

tatctacttc gacttgctca tctacgttcc acaaccacga ttcgactgga acgagagcgc    5940

atcccgaggt tccattctga agattgcttt gcactcgatc actcatcaaa gtctctggaa    6000

ccgtctcagc ctctacgccc ttatgtaccg ggacaggggt attcacggtc aaatacactg    6060

cccgccagcc ctcaggcact ggcacgtcac cgcacgcgct ggtcttcgag tacggcgacg    6120

tgatgacctt ccatctgggg ttagtccact ggatcccatc ggcgctcaat tccggattca    6180

ctcggatgta tccaggtatc tctctgcatg cactgacaga tggaacagaa cctgtcggaa    6240

gaggggatct gcaccaggtc accgttcgtt cagcccatga gtcccgacgc tcttgcattc    6300

cgctggaaag cttaatatct tgcgtgccaa caat                                6334
```

<210> 6

<211> 11241

<212> DNA

<213> Plasmid pRHBR17

<400> 6
```
ttctcatgtt tgacagctta tcatcgataa gctttaatgc ggtagtttat cacagttaaa     60

ttgctaacgc agtcaggcac cgtgtatgaa atctaacaat gcgctcatcg tcatcctcgg    120

caccgtcacc ctggatgctg taggcatagg cttggttatg ccggtactgc cgggcctctt    180

gcgggatatc gtccattccg acagcatcgc cagtcactat ggcgtgctgc tagcgctata    240

tgcgttgatg caatttctat gcgcacccgt ctcggagca ctgtccgacc gctttggccg    .  300

ccgcccagtc ctgctcgctt cgctacttgg agccactatc gactacgcga tcatggcgac    360

cacacccgtc ctgtggatcc tctacgccgg acgcatcgtg gccggcatca ccggcgccac    420

aggtgcggtt gctggcgcct atatcgccga catcaccgat ggggaagatc gggctcgcca    480

cttcgggctc atgagcgctt gtttcggcgt gggtatggtg gcaggccccg tggccggggg    540

actgttgggc gccatctcct tgcatgcacc attccttgcg gcggcggtgc tcaacggcct    600

caacctacta ctgggctgct tcctaatgca ggagtcgcat aagggagagc gtcgaccgat    660

gcccttgaga gccttcaacc cagtcagctc cttccggtgg gcgcggggca tgactatcgt    720

cgccgcactt atgactgtct ctttatcat gcaactcgta ggacaggtgc cggcagcgct    780
```
```
                                    9
```

```
ctgggtcatt ttcggcgagg accgctttcg ctggagcgcg acgatgatcg gcctgtcgct      840

tgcggtattc ggaatcttgc acgccctcgc tcaagccttc gtcactggtc ccgccaccaa      900

acgtttcggc gagaagcagg ccattatcgc cggcatggcg gccgacgcgc tgggctacgt      960

cttgctggcg ttcgcgacgc gaggctggat ggccttcccc attatgattc ttctcgcttc     1020

cggcggcatc gggatgcccg cgttgcaggc catgctgtcc aggcaggtag atgacgacca     1080

tcagggacag cttcaaggat cgctcgcggc tcttaccagc ctaacttcga tcactggacc     1140

gctgatcgtc acggcgattt atgccgcctc ggcgagcaca tggaacgggt tggcatggat     1200

tgtaggcgcc gccctatacc ttgtctgcct ccccgcgttg cgtcgcggtg catggagccg     1260

ggccacctcg acctgaatgg aagccggcgg cacctcgcta acggattcac cactccaaga     1320

attggagcca atcaattctt gcggagaact gtgaatgcgc aaaccaaccc ttggcagaac     1380

atatccatcg cgtccgccat ctccagcagc cgcacgcggc gcatctcggg ccgcgttgct     1440

ggcgtttttc cataggctcc gcccccctga cgagcatcac aaaaatcgac gctcaagtca     1500

gaggtggcga aacccgacag gactataaag ataccaggcg tttccccctg gaagctccct     1560

cgtgcgctct cctgttccga ccctgccgct taccggatac ctgtccgcct ttctcccttc     1620

gggaagcgtg gcgctttctc atagctcacg ctgtaggtat ctcagttcgg tgtaggtcgt     1680

tcgctccaag ctgggctgtg tgcacgaacc ccccgttcag cccgaccgct gcgccttatc     1740

cggtaactat cgtcttgagt ccaacccggt aagacacgac ttatcgccac tggcagcagc     1800

cactggtaac aggattagca gagcgaggta tgtaggcggt gctacagagt tcttgaagtg     1860

gtggcctaac tacggctaca ctagaaggac agtatttggt atctgcgctc tgctgaagcc     1920

agttaccttc ggaaaaagag ttggtagctc ttgatccggc aaacaaacca ccgctggtag     1980

cggtggtttt tttgtttgca agcagcagat tacgcgcaga aaaaaggat ctcaagaaga     2040

tcctttgatc ttttctacgg ggtctgacgc tcagtggaac gaaaactcac gttaagggat     2100

tttggtcatg agattatcaa aaaggatctt cacctagatc cttttaaatt aaaaatgaag     2160

ttttaaatca atctaaagta tatatgagta aacttggtct gacagttacc aatgcttaat     2220

cagtgaggca cctatctcag cgatctgtct atttcgttca tccatagttg cctgactccc     2280

cgtcgtgtag ataactacga tacgggaggg cttaccatct ggccccagtg ctgcaatgat     2340

accgcgagac ccacgctcac cggctccaga tttatcagca ataaaccagc cagccggaag     2400

ggccgagcgc agaagtggtc ctgcaacttt atccgcctcc atccagtcta ttaattgttg     2460

ccgggaagct agagtaagta gttcgccagt taatagtttg cgcaacgttg ttgccattgc     2520

tgcaggcatc gtggtgtcac gctcgtcgtt tggtatggct tcattcagct ccggttccca     2580

acgatcaagg cgagttacat gatcccccat gttgtgcaaa aaagcggtta gctccttcgg     2640

tcctccgatc gttgtcagaa gtaagttggc cgcagtgtta tcactcatgg ttatggcagc     2700
```

10

```
actgcataat tctcttactg tcatgccatc cgtaagatgc ttttctgtga ctggtgagta    2760

ctcaaccaag tcattctgag aatagtgtat gcggcgaccg agttgctctt gcccggcgtc    2820

aacacgggat aataccgcgc cacatagcag aactttaaaa gtgctcatca ttggaaaacg    2880

ttcttcgggg cgaaaactct caaggatctt accgctgttg agatccagtt cgatgtaacc    2940

cactcgtgca cccaactgat cttcagcatc ttttactttc accagcgttt ctgggtgagc    3000

aaaaacagga aggcaaaatg ccgcaaaaaa gggaataagg gcgacacgga aatgttgaat    3060

actcatactc ttcctttttc aatattattg aagcatttat cagggttatt gtctcatgag    3120

cggatacata tttgaatgta tttagaaaaa taaacaaata ggggttccgc gcacatttcc    3180

ccgaaaagtg ccacctgacg tctaagaaac cattattatc atgacattaa cctataaaaa    3240

taggcgtatc acgaggccct ttcgtcttcg aataaatacc tgtgacggaa gatcacttcg    3300

cagaataaat aaatcctggt gtccctgttg ataccgggaa gccctgggcc aacttttggc    3360

gaaaatgaga cgttgatcgg cacgtaagag gttccaactt tcaccataat gaaataagat    3420

cactaccggg cgtatttttt gagttatcga gattttcagg agctaaggaa gctaaaatgg    3480

agaaaaaaat cactggatat accaccgttg atatatccca atggcatcgt aaagaacatt    3540

ttgaggcatt tcagtcagtt gctcaatgta cctataacca gaccgttcag attcagacca    3600

acaatcagtc caactagcaa ggcgacaacc ggtatcgcaa ttcgtgaaac aagctttgtc    3660

atgcgtccgc gctcttacga gcaggtgcgg agacggccgc tgcaggcatt ggaaccaaat    3720

tctccactgt gatggatagt gcgagacgat ccatgccagt catgtagggc tgcacccaga    3780

caaggccttc tgctcggtag atcgtgccga agctgaacgg ctcgttcggc gggttgatga    3840

cgtgcacgga tgctgtcttg tcagtcgcaa cagttccgtc cttgcgtgca actcggagca    3900

atgcgccagt cgaatacttc acacggccgt cgggagtgag cttgtcctga accggcttga    3960

tggggtcgtc cataccggct acgaacaccg ggaactgatc agcggtagtt gcgacgggga    4020

gggacgttcc gagctgaaca ttcatgcgag ttcctttgat cgaggctggt acagcttatg    4080

tctccggtgt ccatattcag cgacacgcgt tcatctacac tcaaaaccgt acacatagtg    4140

tagccagctg tccagttttc gcacactacg ttagcaactg aacatatttt gtggttgatc    4200

agtcaataag ctgtccatat ggacgagaaa gaggttcgcg cgatgattca gcgcaaagaa    4260

accgaacgaa aaatgcaggt catcaagcag gcgtccgtgg atctgtcaca ctcctggcag    4320

accattcaga acgcgcacga ctccacgact gtcgcaatgg agctacgaga agccgggctt    4380

caacgcgaat tctggctaca agctctcgcg gacatcacat ctgttgtggg aactgcctct    4440

gagctgcgca aatctatttc ccgttttctc gttgacgagc ttgacgtcag cagccgaacc    4500

gttgccaccg ttgcagatgt ttcaccgtcg accatcagta cttggcgtgg tgagcatgag    4560

tcatcgtaaa aacatcctct gacctgctat ggccccaatg atcacctatt accaaggcgg    4620
```

11

```
cggcttcgcc gccgctgcca gcaggctccc ccacctacgc gctccgcttc gctcgcgctt    4680

cggtgctccg cccgcaggcc caggagcgag tttgcgcctc gtttagtcca tctaaggggt    4740

tcctagctgg cttgaggtcg caacgcatcc tgaagtcgat cgaggagcag gaacgcatca    4800

tctcgatcca gcgtggtttc ttgaccataa atcgagaggt acacgcccat gacaacgcca    4860

tcgacgtcta ccgaagctgg attcgctgcg atgccaagag gacgttcgtt gatgctcatg    4920

tgatgggttt acctgcaaaa atagtcagca gccaaatcgg aggcggcggc ttcgccgccg    4980

ctgccagcag gctcccccac ctacgcgctc cgcttcgctc gcgcttcggt gctccgcccg    5040

caggcccagg agcgagtttg cgcctcgttt agtccatcta aggggttcct agctggcttg    5100

aggtcgcaac gcatcctgaa gtcgatcgag gagcaggaac gcatcatctc gatccagcgt    5160

ggtttcttga ccataaatcg agaggtacac gcccatgaca acgccatcga cgtctaccga    5220

agctggattc gctgcgatgc caagaggacg ttcgttgatg ctcatgtgat gggtttacct    5280

gcaaaaatag tcagcagcca aatcggccgg ccttttctta tctgcccggt cagcccccg    5340

agaccaacca tgaaacaggc cgtctctctg tcaaggccaa gccgctacgc ggtgctatcg    5400

cagccctgac agagagacac ccagcttcag agcggcaagt atcgggggga tgccctcaag    5460

tgtggttcat gcgggtgaaa gttgttgctc agcaacgctt ttcacttgcg aaccgatatt    5520

atcgggggcc gcacatccgc tgcgggcaat cgataatgca agtgatcacg aagattttcc    5580

caagtcgcgc cagcttcgac gagtccgagg atctcgccga agacgtaagg cgcacaagtc    5640

cgaatcatca tccacgatcg cgccggaatg atcgcaacca tgaccggggc agattcttcc    5700

tgctcaacga tctgagcatc tgttagttct gccccaagac cagctcgggc acgcaatcca    5760

cgggaccacg cgattgcccg acgtccatc gaaccaaact caaattctcg ccacagttcc    5820

aacgcttgtg gatccccgcc cactgcatca acagcgattt cccaggtgc acggttgcca    5880

tgtcgaccac tttttccgtc gccactacca acctccatac caacgccaga tgcaatttc    5940

gtcagatacg cagcgagaac ttgatcagct tcaccgccga tctttcgtac atcgagacca    6000

cccgaattac gtagtggcgc agcaaatccc agagatacga gtttggaagt ccaccgatcg    6060

aacatcgcat ccgagaagga ttcgaggatg ttctcactca cgtcaccact gaacatgagt    6120

agcgcgtgaa cgtggacgtg ccagccgttt tttccgtgag tgatttcaac agcgcgcacg    6180

tatccgtcgc agccgtacat ttcacgttcc gtacgccaac gacgaccgtt ggtcgcagct    6240

ttccaggctg ccgaaagtcc agtccatagg tcgtggagcc gctgaccagc tgtatggcgc    6300

atggtcatcg tcaccatcgc aacagatcca gtcccgagtt gatgagcaac aacttgagaa    6360

atttcgtctg cacgatgtgc accgactttt cccgcacagc agggggcagat ccagcccttt    6420

ccgcaggaac gaaggcctcc gaatccagaa cctttcggac cgttgacaat ggtcacaccg    6480

ttcacgccag aaatcggccg gccacaggcg ttaaatgttt ctgacgtggt gatttgttga    6540
```

12

```
agtttgggtc gcagttcgtg ccggatgccg cgcttatcgg acgacacgag gacgggaggc   6600

cggtctttgc cggaaaggtg ttcagcactt acgctggtca taacgagcgg ggtcctagtc   6660

aagtaggagc ctcgaaggcg gcggcagggt ggtccaacac ccttcgtcgc cgctcgtatt   6720

ttcggagtaa atccagctag ttcagctcgg atactccact tcgaggttca tcgattattt   6780

ggttttttatc cacttaacca gcagaaacag cgtttatcgc tgatctgctg gtcagtgcgg   6840

cgtgtcgggg gagtcgctag tccgcggcga gtccccatgc ttcgagaaca ccgaccttct   6900

cttctggggt tctgcttgtc ttcaccagtg catcgaacag acctcggtat tcacccaagt   6960

gttcaatatc gaatccggct tccctggcgt aatcaggggt gtagtagcag cacatcgcag   7020

ccagaatctc ggacgattcg gcgcgttcac cagcatgaat ccaaccataa acgtcatgcc   7080

caccccatag atcaggccct cgatgatcgt aaatgccaac ggctagtcgg aggatgaata   7140

ccgtagcttc gtgcttcacg catcaaccct ctgatctgct gcactcagaa ttgcatgacc   7200

tcccgaatga ctgcataact cgtcgtagac ctgagcaacg aacgaaggcc gatcagcatt   7260

gtccatgaag agttggacga acttcggccg gacgaggcca atccacggcg cagtcaaagt   7320

ttcaaaatca tgtgcctcga ggtgctcatg cattgcaacc gcccatgcgg cccctcgagc   7380

ggcgcaccag tctcgttcaa ctccctcgct gtccgaaatg tcgtatttaa ggcccagtga   7440

tcgtccaact tcggcagctg cgtcactggc acgtttccaa tcgtcaccgc gtaagtcgtt   7500

gagctttccg agttcatcgc ctagaagcag ctcagacatt gcaaaaacgg tcatcgaact   7560

gacccatcgt ggaccgacta gtgcaccaag gtcgtcgtcg gtgatctgca tgccgcgaag   7620

ttcgtcgacg acagcttggc cttccaaacc tactctggcc ctgagtattt cagttattac   7680

gagatgatcg ttcggccagc ctgatttgat ccggagtgca gtcgttacga ctcgttccgt   7740

gggcaggttt cggcgtgagg cgagttttc tcctgcctca tgtgcaacct tctcaaattg   7800

ctgtcgaatg taggtgttta ccgggattgc gtctgtcggg tagccgatca aggtgtgtcc   7860

tcctgtgtgt tcggttgtca gcctatgtcg ccgagatgtg ggtattccga ggcgattgtc   7920

attcgttgtg ctcggtcgat gttcagtgcg gcttcgtacg cgaggtctgc gttttcgacg   7980

taactcgcgt aggtcgagta ctcacctacg cgaaccgttc ggatcatttg gcgccgtagt   8040

ccgggttggt cgaagaagcc ttgaccaggg acgaatcctt cgaccagtgc gcactcttca   8100

ggtgttgcgt tggggtgcag cattttgaca gattcaggtt cgtctacgcg gagagtcatt   8160

ttcaccgcga agttcgagcg ggcgtttcca cccacgatgg aagcttccgc acgttgagcc   8220

aagagcaaca ttctgatgcc tgctttggca gactgagcag cgatctgtcg aacaagcgat   8280

gtgatgcggg gtgcgtatct gtctgctggt ttcagaccgt tggttgcatc gaaatcctgt   8340

gcgccctcga tgattccggg aaattcttcc agtacgagca ggatgagagg tagtgctggc   8400

gagaacaacg aaattttgtc tatgcgtcga tcccagaaac actcgattcg tcggtcagat   8460
```

13

```
tctgctttga cgaactggag cactcggagg actttgtcaa aatcgttcag cccgagctcg    8520

atgttcggtt cagccggtcg tcggtggacg aatggggcta gtaagacgga agtgggatcg    8580

actccgacga cacgcacagc gggattcgat ccagcctgtg cgagcaggtt gtaggtgcat    8640

tgagattttc cggaacgggt tttgccttga atgagccagt gagcagcatc tttggctata    8700

tcgaccatga caggttgagc tagttcgttc catccaatcg caatcgggat cgtgtctgtt    8760

tgatccatca ggcgtccgtg cttttgtcga acggaagatc cttttcttgc tcccaccagg    8820

gccgattgtc cccgagtatg ccgccggcct cttccttcaa tgtgccggcc gatgagtcct    8880

cgacgtcact gagccatgct gcatctcgtg cttgagaaat ggtgtctgca tcgatcagaa    8940

gtagctcgac ccgacgcggc tctactttgg tgaaactggc acgtagagca ccgaaagcat    9000

cggctatttt gaccgtcttc gatgtcatat cttcaccggt gatccctgtc ggaaggtcga    9060

aagcgactga tcgagtcaat ccgtcgtccg aaaatttgta gctacgaatg atgggaggct    9120

gcccagagga gttgatcaga ccaagattgg ccgcagcacc tgcaacttcc ggggttcctc    9180

gccaccatcg agctgtacga cgtttgcgac gccgagcctt cgttgcctct ctcaggtaga    9240

ccattgccac aacgcacacc agcagcacac tgaccaaaag ccacatctga gcgtcgaaga    9300

tgtacagcag cagaagcaac agaaacgtag aggacagaat cgggtaatcg gcaatttttg    9360

ccttgagttt tgctcgcaaa atttgccagg tggaacgtct tttaacctgg tcaccgcgtc    9420

gaacggcttc gtagttgctc atcggggcca ctccacaacg acattcggac tatctacttc    9480

gacttgctca tctacgttcc acaaccacga ttcgactgga acgagagcgc atcccgaggt    9540

tccattctga agattgcttt gcactcgatc actcatcaaa gtctctggaa ccgtctcagc    9600

ctctacgccc ttatgtaccg ggacaggggt attcacggtc aaatacactg cccgccagcc    9660

ctcaggcact ggcacgtcac cgcacgcgct ggtcttcgag tacggcgacg tgatgacctt    9720

tccatctggg ttagtccact ggatcccatc ggcgctcaat tccggattca ctcggatgta    9780

tccaggtatc tctctgcatg cactgacaga tggaacagaa cctgtcggaa gaggggatct    9840

gcaccaggtc accgttcgtt cagcccatga gtcccgacgc tcttgcattc cgctggaaag    9900

cttaatatct tgcgtgccaa caatctggat attacggcct ttttaaagac cgtaaagaaa    9960

aataagcaca agttttatcc ggcctttatt cacattcttg cccgcctgat gaatgctcat   10020

ccggaattcc gtatggcaat gaaagacggt gagctggtga tatgggatag tgttcaccct   10080

tgttacaccg ttttccatga gcaaactgaa acgttttcat cgctctggag tgaataccac   10140

gacgatttcc ggcagtttct acacatatat tcgcaagatg tggcgtgtta cggtgaaaac   10200

ctggcctatt tccctaaagg gtttattgag aatatgtttt tcgtctcagc caatccctgg   10260

gtgagtttca ccagttttga tttaaacgtg gccaatatgg acaacttctt cgcccccgtt   10320

ttcaccatgg gcaaatatta tacgcaaggc gacaaggtgc tgatgccgct ggcgattcag   10380
```

14

```
gttcatcatg ccgtttgtga tggcttccat gtcggcagaa tgcttaatga attacaacag   10440

tactgcgatg agtggcaggg cggggcgtaa tttttttaag gcagttattg gtgcccttaa   10500

acgcctggtg ctacgcctga ataagtgata ataagcggat gaatggcaga aattcgaaag   10560

caaattcgac ccggtcgtcg gttcagggca gggtcgttaa atagccgctt atgtctattg   10620

ctggtttacc ggtttattga ctaccggaag cagtgtgacc gtgtgcttct caaatgcctg   10680

aggccagttt gctcaggctc tccccgtgga ggtaataatt gacgatatga tcatttattc   10740

tgcctcccag agcctgataa aaacggtgaa tccgttagcg aggtgccgcc ggcttccatt   10800

caggtcgagg tggcccggct ccatgcaccg cgacgcaacg cggggaggca gacaaggtat   10860

agggcggcgc ctacaatcca tgccaacccg ttccatgtgc tcgccgaggc ggcataaatc   10920

gccgtgacga tcagcggtcc agtgatcgaa gttaggctgg taagagccgc gagcgatcct   10980

tgaagctgtc cctgatggtc gtcatctacc tgcctggaca gcatggcctg caacgcgggc   11040

atcccgatgc cgccggaagc gagaagaatc ataatgggga aggccatcca gcctcgcgtc   11100

gcgaacgcca gcaagacgta gcccagcgcg tcggccgcca tgccggcgat aatggcctgc   11160

ttctcgccga aacgtttggt ggcgggacca gtgacgaagg cttgagcgag ggcgtgcaag   11220

attccgaata ccgcaagcga c                                              11241


<210>   7

<211>   9652

<212>   DNA

<213>   Plasmid pRHBR17


<400>   7
ttctcatgtt tgacagctta tcatcgataa gctttaatgc ggtagtttat cacagttaaa     60

ttgctaacgc agtcaggcac cgtgtatgaa atctaacaat gcgctcatcg tcatcctcgg    120

caccgtcacc ctggatgctg taggcatagg cttggttatg ccggtactgc cgggcctctt    180

gcgggatatc gtccattccg acagcatcgc cagtcactat ggcgtgctgc tagcgctata    240

tgcgttgatg caatttctat gcgcacccgt tctcggagca ctgtccgacc gctttggccg    300

ccgcccagtc ctgctcgctt cgctacttgg agccactatc gactacgcga tcatggcgac    360

cacacccgtc ctgtggatcc tctacgccgg acgcatcgtg gccggcatca ccggcgccac    420

aggtgcggtt gctggcgcct atatcgccga catcaccgat ggggaagatc gggctcgcca    480

cttcgggctc atgagcgctt gtttcggcgt gggtatggtg gcaggccccg tggccggggg    540

actgttgggc gccatctcct tgcatgcacc attccttgcg gcggcggtgc tcaacggcct    600

caacctacta ctgggctgct tcctaatgca ggagtcgcat aagggagagc gtcgaccgat    660
```

15

```
gcccttgaga gccttcaacc cagtcagctc cttccggtgg gcgcggggca tgactatcgt      720

cgccgcactt atgactgtct tctttatcat gcaactcgta ggacaggtgc cggcagcgct      780

ctgggtcatt ttcggcgagg accgctttcg ctggagcgcg acgatgatcg gcctgtcgct      840

tgcggtattc ggaatcttgc acgccctcgc tcaagccttc gtcactggtc ccgccaccaa      900

acgtttcggc gagaagcagg ccattatcgc cggcatggcg ccgacgcgc tgggctacgt       960

cttgctggcg ttcgcgacgc gaggctggat ggccttcccc attatgattc ttctcgcttc     1020

cggcggcatc gggatgcccg cgttgcaggc catgctgtcc aggcaggtag atgacgacca     1080

tcagggacag cttcaaggat cgctcgcggc tcttaccagc ctaacttcga tcactggacc     1140

gctgatcgtc acggcgattt atgccgcctc ggcgagcaca tggaacgggt tggcatggat     1200

tgtaggcgcc gccctatacc ttgtctgcct ccccgcgttg cgtcgcggtg catggagccg     1260

ggccacctcg acctgaatgg aagccggcgg cacctcgcta acggattcac cactccaaga     1320

attggagcca atcaattctt gcggagaact gtgaatgcgc aaaccaaccc ttggcagaac     1380

atatccatcg cgtccgccat ctccagcagc cgcacgcggc gcatctcggg ccgcgttgct     1440

ggcgtttttc cataggctcc gcccccctga cgagcatcac aaaaatcgac gctcaagtca     1500

gaggtggcga aacccgacag gactataaag ataccaggcg tttcccctg gaagctccct       1560

cgtgcgctct cctgttccga ccctgccgct taccggatac ctgtccgcct ttctcccttc     1620

gggaagcgtg gcgctttctc atagctcacg ctgtaggtat ctcagttcgg tgtaggtcgt     1680

tcgctccaag ctgggctgtg tgcacgaacc ccccgttcag cccgaccgct gcgccttatc     1740

cggtaactat cgtcttgagt ccaacccggt aagacacgac ttatcgccac tggcagcagc     1800

cactggtaac aggattagca gagcgaggta tgtaggcggt gctacagagt tcttgaagtg     1860

gtggcctaac tacggctaca ctagaaggac agtatttggt atctgcgctc tgctgaagcc     1920

agttaccttc ggaaaaagag ttggtagctc ttgatccggc aaacaaacca ccgctggtag     1980

cggtggtttt tttgtttgca agcagcagat tacgcgcaga aaaaaggat ctcaagaaga       2040

tcctttgatc ttttctacgg ggtctgacgc tcagtggaac gaaaactcac gttaagggat     2100

tttggtcatg agattatcaa aaaggatctt cacctagatc cttttaaatt aaaaatgaag     2160

ttttaaatca atctaaagta tatatgagta aacttggtct gacagttacc aatgcttaat     2220

cagtgaggca cctatctcag cgatctgtct atttcgttca tccatagttg cctgactccc     2280

cgtcgtgtag ataactacga tacgggaggg cttaccatct ggccccagtg ctgcaatgat     2340

accgcgagac ccacgctcac cggctccaga tttatcagca ataaaccagc cagccggaag     2400

ggccgagcgc agaagtggtc ctgcaacttt atccgcctcc atccagtcta ttaattgttg     2460

ccgggaagct agagtaagta gttcgccagt taatagtttg cgcaacgttg ttgccattgc     2520

ttcatctaca ctcaaaaccg tacacatagt gtagccagct gtccagtttt cgcacactac     2580
```

16

```
gttagcaact gaacatattt tgtggttgat cagtcaataa gctgtccata tggacgagaa    2640

agaggttcgc gcgatgattc agcgcaaaga aaccgaacga aaaatgcagg tcatcaagca    2700

ggcgtccgtg gatctgtcac actcctggca gaccattcag aacgcgcacg actccacgac    2760

tgtcgcaatg gagctacgag aagccgggct tcaacgcgaa ttctggctac aagctctcgc    2820

ggacatcaca tctgttgtgg gaactgcctc tgagctgcgc aaatctattt cccgttttct    2880

cgttgacgag cttgacgtca gcagccgaac cgttgccacc gttgcagatg tttcaccgtc    2940

gaccatcagt acttggcgtg gtgagcatga gtcatcgtaa aaacatcctc tgacctgcta    3000

tggccccaat gatcacctat taccaaggcg gcggcttcgc cgccgctgcc agcaggctcc    3060

cccacctacg cgctccgctt cgctcgcgct tcggtgctcc gcccgcaggc ccaggagcga    3120

gtttgcgcct cgtttagtcc atctaagggg ttcctagctg gcttgaggtc gcaacgcatc    3180

ctgaagtcga tcgaggagca ggaacgcatc atctcgatcc agcgtggttt cttgaccata    3240

aatcgagagg tacacgccca tgacaacgcc atcgacgtct accgaagctg gattcgctgc    3300

gatgccaaga ggacgttcgt tgatgctcat gtgatgggtt tacctgcaaa aatagtcagc    3360

agccaaatcg gaggcggcgg cttcgccgcc gctgccagca ggctccccca cctacgcgct    3420

ccgcttcgct cgcgcttcgg tgctccgccc gcaggcccag gagcgagttt gcgcctcgtt    3480

tagtccatct aaggggttcc tagctggctt gaggtcgcaa cgcatcctga agtcgatcga    3540

ggagcaggaa cgcatcatct cgatccagcg tggtttcttg accataaatc gagaggtaca    3600

cgcccatgac aacgccatcg acgtctaccg aagctggatt cgctgcgatg ccaagaggac    3660

gttcgttgat gctcatgtga tgggtttacc tgcaaaaata gtcagcagcc aaatcggccg    3720

gccttttttct atctgcccgg tcagcccccc gagaccaacc atgaaacagg ccgtctctct    3780

gtcaaggcca agccgctacg cggtgctatc gcagccctga cagagagaca cccagcttca    3840

gagcggcaag tatcggggggg atgccctcaa gtgtggttca tgcgggtgaa agttgttgct    3900

cagcaacgct tttcacttgc gaaccgatat tatcgggggc cgcacatccg ctgcgggcaa    3960

tcgataatgc aagtgatcac gaagattttc ccaagtcgcg ccagcttcga cgagtccgag    4020

gatctcgccg aagacgtaag gcgcacaagt ccgaatcatc atccacgatc gcgccggaat    4080

gatcgcaacc atgaccgggg cagattcttc ctgctcaacg atctgagcat ctgttagttc    4140

tgccccaaga ccagctcggg cacgcaatcc acgggaccac gcgattgccc gacgtcccat    4200

cgaaccaaac tcaaattctc gccacagttc caacgcttgt ggatccccgc ccactgcatc    4260

aacagcgatt tcccagggtg cacggttgcc atgtcgacca cttttttccgt cgccactacc    4320

aacctccata ccaacgccag atgcaatttt cgtcagatac gcagcgagaa cttgatcagc    4380

ttcaccgccg atctttcgta catcgagacc acccgaatta cgtagtggcg cagcaaatcc    4440

cagagatacg agtttggaag tccaccgatc gaacatcgca tccgagaagg attcgaggat    4500
```

17

```
gttctcactc acgtcaccac tgaacatgag tagcgcgtga acgtggacgt gccagccgtt    4560

tttttccgtga gtgatttcaa cagcgcgcac gtatccgtcg cagccgtaca tttcacgttc    4620

cgtacgccaa cgacgaccgt tggtcgcagc tttccaggct gccgaaagtc cagtccatag    4680

gtcgtggagc cgctgaccag ctgtatggcg catggtcatc gtcaccatcg caacagatcc    4740

agtcccgagt tgatgagcaa caacttgaga aatttcgtct gcacgatgtg caccgacttt    4800

tcccgcacag caggggcaga tccagccctt tccgcaggaa cgaaggcctc cgaatccaga    4860

acctttcgga ccgttgacaa tggtcacacc gttcacgcca gaaatcggcc ggccacaggc    4920

gttaaatgtt tctgacgtgg tgatttgttg aagtttgggt cgcagttcgt gccggatgcc    4980

gcgcttatcg gacgacacga ggacgggagg ccggtctttg ccggaaaggt gttcagcact    5040

tacgctggtc ataacgagcg gggtcctagt caagtaggag cctcgaaggc ggcggcaggg    5100

tggtccaaca cccttcgtcg ccgctcgtat tttcggagta aatccagcta gttcagctcg    5160

gatactccac ttcgaggttc atcgattatt tggttttat ccacttaacc agcagaaaca    5220

gcgtttatcg ctgatctgct ggtcagtgcg gcgtgtcggg ggagtcgcta gtccgcggcg    5280

agtccccatg cttcgagaac accgaccttc tcttctgggg ttctgcttgt cttcaccagt    5340

gcatcgaaca gacctcggta ttcacccaag tgttcaatat cgaatccggc ttccctggcg    5400

taatcagggg tgtagtagca gcacatcgca gccagaatct cggacgattc ggcgcgttca    5460

ccagcatgaa tccaaccata aacgtcatgc ccaccccata gatcaggccc tcgatgatcg    5520

taaatgccaa cggctagtcg gaggatgaat accgtagctt cgtgcttcac gcatcaaccc    5580

tctgatctgc tgcactcaga attgcatgac ctcccgaatg actgcataac tcgtcgtaga    5640

cctgagcaac gaacgaaggc cgatcagcat tgtccatgaa gagttggacg aacttcggcc    5700

ggacgaggcc aatccacggc gcagtcaaag tttcaaaatc atgtgcctcg aggtgctcat    5760

gcattgcaac cgcccatgcg gcccctcgag cggcgcacca gtctcgttca actccctcgc    5820

tgtccgaaat gtcgtattta aggcccagtg atcgtccaac ttcggcagct gcgtcactgg    5880

cacgtttcca atcgtcaccg cgtaagtcgt tgagctttcc gagttcatcg cctagaagca    5940

gctcagacat tgcaaaaacg gtcatcgaac tgacccatcg tggaccgact agtgcaccaa    6000

ggtcgtcgtc ggtgatctgc atgccgcgaa gttcgtcgac gacagcttgg ccttccaaac    6060

ctactctggc cctgagtatt tcagttatta cgagatgatc gttcggccag cctgatttga    6120

tccggagtgc agtcgttacg actcgttccg tgggcaggtt tcggcgtgag gcgagttttt    6180

ctcctgcctc atgtgcaacc ttctcaaatt gctgtcgaat gtaggtgttt accgggattg    6240

cgtctgtcgg gtagccgatc aaggtgtgtc ctcctgtgtg ttcggttgtc agcctatgtc    6300

gccgagatgt gggtattccg aggcgattgt cattcgttgt gctcggtcga tgttcagtgc    6360

ggcttcgtac gcgaggtctg cgttttcgac gtaactcgcg taggtcgagt actcacctac    6420
```

18

```
gcgaaccgtt cggatcattt ggcgccgtag tccgggttgg tcgaagaagc cttgaccagg    6480

gacgaatcct tcgaccagtg cgcactcttc aggtgttgcg ttggggtgca gcattttgac    6540

agattcaggt tcgtctacgc ggagagtcat tttcaccgcg aagttcgagc gggcgtttcc    6600

acccacgatg gaagcttccg cacgttgagc caagagcaac attctgatgc ctgctttggc    6660

agactgagca gcgatctgtc gaacaagcga tgtgatgcgg ggtgcgtatc tgtctgctgg    6720

tttcagaccg ttggttgcat cgaaatcctg tgcgccctcg atgattccgg gaaattcttc    6780

cagtacgagc aggatgagag gtagtgctgg cgagaacaac gaaattttgt ctatgcgtcg    6840

atcccagaaa cactcgattc gtcggtcaga ttctgctttg acgaactgga gcactcggag    6900

gactttgtca aaatcgttca gcccgagctc gatgttcggt tcagccggtc gtcggtggac    6960

gaatggggct agtaagacgg aagtgggatc gactccgacg acacgcacag cgggattcga    7020

tccagcctgt gcgagcaggt tgtaggtgca ttgagatttt ccggaacggg ttttgccttg    7080

aatgagccag tgagcagcat ctttggctat atcgaccatg acaggttgag ctagttcgtt    7140

ccatccaatc gcaatcggga tcgtgtctgt ttgatccatc aggcgtccgt gcttttgtcg    7200

aacggaagat ccttttcttg ctcccaccag ggccgattgt ccccgagtat gccgccggcc    7260

tcttccttca atgtgccggc cgatgagtcc tcgacgtcac tgagccatgc tgcatctcgt    7320

gcttgagaaa tggtgtctgc atcgatcaga agtagctcga cccgacgcgg ctctactttg    7380

gtgaaactgg cacgtagagc accgaaagca tcggctattt tgaccgtctt cgatgtcata    7440

tcttcaccgg tgatccctgt cggaaggtcg aaagcgactg atcgagtcaa tccgtcgtcc    7500

gaaaatttgt agctacgaat gatgggaggc tgcccagagg agttgatcag accaagattg    7560

gccgcagcac ctgcaacttc cggggttcct cgccaccatc gagctgtacg acgtttgcga    7620

cgccgagcct tcgttgcctc tctcaggtag accattgcca caacgcacac cagcagcaca    7680

ctgaccaaaa gccacatctg agcgtcgaag atgtacagca gcagaagcaa cagaaacgta    7740

gaggacagaa tcgggtaatc ggcaattttt gccttgagtt ttgctcgcaa aatttgccag    7800

gtggaacgtc ttttaacctg gtcaccgcgt cgaacggctt cgtagttgct catcggggcc    7860

actccacaac gacattcgga ctatctactt cgacttgctc atctacgttc cacaaccacg    7920

attcgactgg aacgagagcg catcccgagg ttccattctg aagattgctt tgcactcgat    7980

cactcatcaa agtctctgga accgtctcag cctctacgcc cttatgtacc gggacagggg    8040

tattcacggt caaatacact gcccgccagc cctcaggcac tggcacgtca ccgcacgcgc    8100

tggtcttcga gtacggcgac gtgatgacct ttccatctgg gttagtccac tggatcccat    8160

cggcgctcaa ttccggattc actcggatgt atccaggtat ctctctgcat gcactgacag    8220

atggaacaga acctgtcgga agagggatc tgcaccaggt caccgttcgt tcagcccatg    8280

agtcccgacg ctcttgcatt ccgctggaaa gcttaatatc ttgcgtgcca acaatctgga    8340
```

19

```
tattacggcc tttttaaaga ccgtaaagaa aaataagcac aagttttatc cggcctttat    8400

tcacattctt gcccgcctga tgaatgctca tccggaattc cgtatggcaa tgaaagacgg    8460

tgagctggtg atatgggata gtgttcaccc ttgttacacc gttttccatg agcaaactga    8520

aacgttttca tcgctctgga gtgaatacca cgacgatttc cggcagtttc tacacatata    8580

ttcgcaagat gtggcgtgtt acggtgaaaa cctggcctat ttccctaaag ggtttattga    8640

gaatatgttt ttcgtctcag ccaatccctg ggtgagtttc accagttttg atttaaacgt    8700

ggccaatatg gacaacttct tcgcccccgt tttcaccatg ggcaaatatt atacgcaagg    8760

cgacaaggtg ctgatgccgc tggcgattca ggttcatcat gccgtttgtg atggcttcca    8820

tgtcggcaga atgcttaatg aattacaaca gtactgcgat gagtggcagg gcggggcgta    8880

atttttttaa ggcagttatt ggtgccctta aacgcctggt gctacgcctg aataagtgat    8940

aataagcgga tgaatggcag aaattcgaaa gcaaattcga cccggtcgtc ggttcagggc    9000

agggtcgtta aatagccgct tatgtctatt gctggtttac cggtttattg actaccggaa    9060

gcagtgtgac cgtgtgcttc tcaaatgcct gaggccagtt tgctcaggct ctccccgtgg    9120

aggtaataat tgacgatatg atcatttatt ctgcctccca gagcctgata aaaacggtga    9180

atccgttagc gaggtgccgc cggcttccat tcaggtcgag gtggcccggc tccatgcacc    9240

gcgacgcaac gcggggaggc agacaaggta tagggcggcg cctacaatcc atgccaaccc    9300

gttccatgtg ctcgccgagg cggcataaat cgccgtgacg atcagcggtc cagtgatcga    9360

agttaggctg gtaagagccg cgagcgatcc ttgaagctgt ccctgatggt cgtcatctac    9420

ctgcctggac agcatggcct gcaacgcggg catcccgatg ccgccggaag cgagaagaat    9480

cataatgggg aaggccatcc agcctcgcgt cgcgaacgcc agcaagacgt agcccagcgc    9540

gtcggccgcc atgccggcga taatggcctg cttctcgccg aaacgtttgg tggcgggacc    9600

agtgacgaag gcttgagcga gggcgtgcaa gattccgaat accgcaagcg ac           9652
```

<210> 8

<211> 29

<212> DNA

<213> Rhodococcus AN12

<400> 8
gtgcgaaaac tggacagctg gctacacta   29

<210> 9

<211> 19
```

```
<212>    DNA

<213>    Primer


<400>    9
gagtttgatc ctggctcag                                              19


<210>    10

<211>    16

<212>    DNA

<213>    Primer


<400>    10
taccttgtta cgactt                                                 16


<210>    11

<211>    17

<212>    DNA

<213>    Primer


<400>    11
gtgccagcag ymgcggt                                                17


<210>    12

<211>    1424

<212>    DNA

<213>    Rhodococcus AN12


<400>    12
tcgagcggta gagagaagct tgcttctctt gagagcggcg gacgggtgag taatgcctag    60

gaatctgcct ggtagtgggg gataacgttc ggaaacggac gctaataccg catacgtcct   120

acgggagaaa gcaggggacc ttcgggcctt gcgctatcag atgagcctag gtcggattag   180

ctagttggtg aggtaatggc tcaccaaggc gacgatccgt aactggtctg agaggatgat   240

cagtcacact ggaactgaga cacggtccag actcctacgg gaggcagcag tggggaatat   300

tggacaatgg gcgaaagcct gatccagcca tgccgcgtgt gtgaagaagg tcttcggatt   360

gtaaagcact ttaagttggg aggaagggca gttacctaat acgtgattgt tttgacgtta   420

ccgacagaat aagcaccggc taactctgtg ccagcagccg cggtaataca gagggtgcaa   480
```

21

```
gcgttaatcg gaattactgg gcgtaaagcg cgcgtaggtg gtttgttaag ttggatgtga      540

aatccccggg ctcaacctgg gaactgcatt caaaactgac tgactagagt atggtagagg      600

gtggtggaat tcctgtgta gcggtgaaat gcgtagatat aggaaggaac accagtggcg      660

aaggcgacca cctggactga tactgacact gaggtgcgaa agcgtgggga gcaaacagga      720

ttagataccc tggtagtcca cgccgtaaac gatgtcaact agccgttggg agccttgagc      780

tcttagtggc gcagctaacg cattaagttg accgcctggg gagtacggcc gcaaggttaa      840

aactcaaatg aattgacggg ggcccgcaca agcggtggag catgtggttt aattcgaagc      900

aacgcgaaga accttaccag gccttgacat ccaatgaact ttctagagat agattggtgc      960

cttcgggaac attgagacag gtgctgcatg gctgtcgtca gctcgtgtcg tgagatgttg     1020

ggttaagtcc cgtaacgagc gcaacccttg tccttagtta ccagcacgta atggtgggca     1080

ctctaaggag actgccggtg acaaaccgga ggaaggtggg gatgacgtca agtcatcatg     1140

gcccttacgg cctgggctac acacgtgcta caatggtcgg tacagagggt tgccaagccg     1200

cgaggtggag ctaatcccag aaaaccgatc gtagtccgga tcgcagtctg caactcgact     1260

gcgtgaagtc ggaatcgcta gtaatcgcga atcagaatgt cgcggtgaat acgttcccgg     1320

gccttgtaca caccgcccgt cacaccatgg gagtgggttg caccagaagt agctagtcta     1380

accctcggga ggacggttac cacggtgtga ttcatgactg gggt                      1424
```

<210> 13

<211> 17

<212> DNA

<213> Primer

<400> 13
gtaaaacgac ggccagt   17

<210> 14

<211> 24

<212> DNA

<213> Primer

<400> 14
agcggataac aatttcacac agga   24

22

<210> 15

<211> 722

<212> DNA

<213> Rhodococcus AN12

<400> 15
```
aagctttcca gcggaatgca agagcgtcgg gactcatggg ctgaacgaac ggtgacctgg      60
tgcagatccc ctcttccgac aggttctgtt ccatctgtca gtgcatgcag agagatacct     120
ggatacatcc gagtgaatcc ggaattgagc gccgatggga tccagtggac taacccagat     180
ggaaaggtca tcacgtcgcc gtactcgaag accagcgcgt gcggtgacgt gccagtgcct     240
gagggctggc gggcagtgta tttgaccgtg aatacccctg tcccggtaca taagggcgta     300
gaggctgaga cggttccaga gactttgatg agtgatcgag tgcaaagcaa tcttcagaat     360
ggaacctcgg gatgcgctct cgttccagtc gaatcgtggt tgtggaacgt agatgagcaa     420
gtcgaagtag atagtccgaa tgtcgttgtg gagtggcccc gatgagcaac tacgaagccg     480
ttcgacgcgg tgaccaggtt aaaagacgtt ccacctggca aattttgcga gcaaaactca     540
aggcaaaaat tgccgattac ccgattctgt cctctacgtt tctgttgctt ctgctgctgt     600
acatcttcga cgctcagatg tggctttt gg tcagtgtgct gctggtgtgc gttgtggcaa     660
tggtctacct gagagaggca acgaaggctc ggcgtcgcaa acgtcgtaca gctcgatggt     720
gg                                                                      722
```

<210> 16

<211> 523

<212> DNA

<213> Rhodococcus AN12

<400> 16
```
aagcttccgc acgttgagcc aagagcaaca ttctgatgcc tgctttggca gactgagcag      60
cgatctgtcg aacaagcgat gtgatgcggg gtgcgtatct gtctgctggt ttcagaccgt     120
tggttgcatc gaaatcctgt cgcccctcga tgattccggg aaattcttcc agtacgagca     180
ggatgagagg tagtgctggc gagaacaacg aaattttgtc tatgcgtcga tcccagaaac     240
actcgattcg tcggtcagat tctgctttga cgaactggag cactcggagg actttgtcaa     300
aatcgttcag cccgagctcg atgttcggtt casccggtcg tcggtggacg aatggggcta     360
gtaagacgga agtgggatcg actccgacga cacgcacagc gggattcgat ccagcctgtg     420
```

cgagcaggtt gtaggtgcat tgagattttc cggaacgggt tttgccttga atgagccagt 480

gagcagcatc tttggctata tcgaccatga caggttgagc tag 523

<210> 17

<211> 606

<212> DNA

<213> Rhodococcus AN12

<400> 17

aagcttccat cgtgggtgga aacgcccgct cgaacttcgc ggtgaaaatg actctccgcg 60

tagacgaacc tgaatctgtc aaaatgctgc accccaacgc aacacctgaa gagtgcgcac 120

tggtcgaagg attcgtccct ggtcaaggct tcttcgacca acccggacta cggcgccaaa 180

tgatccgaac ggttcgcgta ggtgagtact cgacctacgc gagttacgtc gaaaacgcag 240

acctcgcgta cgaagccgca ctgaacatcg accgagcaca acgaatgaca atcgcctcgg 300

aatacccaca tctcggcgac ataggctgac aaccgaacac acaggaggac acaccttgat 360

cggctacccg acagacgcaa tcccggtaaa cacctacatt cgacagcaat ttgagaaggt 420

tgcacatgag gcaggagaaa aactcgcctc acgccgaaac ctgcccacgg aacgagtcgt 480

aacgactgca ctccggatca aatcaggctg ccgaacgat catctcgtaa taactgaaat 540

actcagggcc agagtaggtt tggaaggcca agctgtcgtc gacgaacttc gcggcatgca 600

gatcac 606

<210> 18

<211> 30

<212> DNA

<213> Primer

<400> 18
actttattgt catagtttag atctattttg 30

<210> 19

<211> 20

<212> DNA

<213> Primer

24

<400> 19
acttgcgaac cgatattatc 20

<210> 20

<211> 20

<212> DNA

<213> Primer

<400> 20
ttatgaccag cgtaagtgct 20

<210> 21

<211> 459

<212> PRT

<213> Arcanobacterium pyogenes

<400> 21

```
Met Asn Arg Leu Ser Glu Arg Thr Ala Leu Ser Leu Pro Ala Arg Gln
1               5                   10                  15


Ile Gln Lys Val Ile Pro Ala Ala Gly Gly Arg Ser Leu Lys Ser Phe
            20                  25                  30


Glu Gly Met Thr Ala Thr Trp Ser Ala Arg Gly Gly Ala Ser Ser Asp
        35                  40                  45


Glu Arg Ser Arg Asp Lys Arg Ser Gln Ile Pro Ser Asn Arg Arg Glu
    50                  55                  60


Gly Arg Ser Ala Thr His Pro Leu Gly Asn Thr Val Leu Thr Phe Pro
65                  70                  75                  80


Val Ser Asn Glu Ser Lys Lys Thr Ala Lys Ser Arg Arg Ser Glu Arg
                85                  90                  95


Tyr Glu Leu Arg Asp Gly Leu Ala Glu Ile Ser Thr Ile Glu Ser Val
            100                 105                 110


Arg Lys Cys Gly Arg Val Pro Val Ala Pro Leu Val Ser Leu Arg Ala
        115                 120                 125


Lys Ser Asp Gly Lys Gly Ala Gly Tyr Gly Gly Leu His Thr Cys Gly
    130                 135                 140
```

Ser Val Trp Ala Cys Pro Val Cys Ser Ala Lys Ile Ala Ala Arg Arg
145   150   155   160

Lys Thr Asp Leu Gln Gln Val Val Asp His Ala Val Lys His Gly Met
                165   170   175

Thr Val Ser Met Leu Thr Leu Thr Gln Arg His His Lys Gly Gln Gly
                180   185   190

Leu Lys His Leu Trp Asp Ala Leu Ser Thr Ala Trp Asn Arg Val Thr
                195   200   205

Ser Gly Arg Arg Trp Ile Glu Phe Lys Glu Gln Phe Gly Leu Val Gly
        210   215   220

Tyr Val Arg Ala Asn Glu Ile Thr His Gly Lys His Gly Trp His Val
225   230   235   240

His Ser His Val Leu Ile Ile Ser Glu Lys Asp Pro Leu Thr Ser Thr
                245   250   255

Phe Val Tyr Gln Arg Lys Gln Gly Arg Arg Arg Leu Pro Tyr Pro Pro
            260   265   270

Glu Ile Tyr Met Ser Ser Asp Phe Ile Ala Glu Arg Trp Glu Ala Gly
            275   280   285

Leu Ala Lys His Gly Val Asp Phe Leu Arg Asp Ser Gly Gly Leu Asp
    290   295   300

Trp Thr Val Ala Lys Asp Ala Arg Ala Ile Gly Asn Tyr Val Ser Lys
305   310   315   320

Met Gln Thr Ser Thr Asp Ala Ile Ser Ser Glu Val Thr Leu Gly Gly
                325   330   335

Phe Lys Lys Ala Arg Asn Gly Asn Arg Thr Pro Phe Gln Ile Leu Ala
            340   345   350

Asp Ile Leu Ser Leu Gly Asp Val Asp Asp Leu Lys Leu Trp Lys Glu
            355   360   365

Tyr Glu Lys Ala Ser Phe Gly Arg Arg Ala Leu Thr Trp Ser Lys Gly
    370   375   380

Leu Arg Asp Trp Ala Asn Leu Gly Val Glu Gln Ser Asp Glu Glu Ile
385   390   395   400

26

```
Ala Ser Glu Glu Ile Gly Asp Glu Ala Ile Ala Leu Phe Thr His Asp
            405                 410              ·           415

Ala Trp Arg Gln Val Arg Arg Phe Gly Ala Ala Glu Leu Leu Asp Val
            420                 425              430

Thr Glu Ser Gly Gly Arg Ala Ala Ala Tyr Arg Trp Leu Asp Phe Arg
            435                 440         ·        445

Glu Ile Asp Trp Ser Leu Pro Pro Lys Ile Glu
    450                 455
```

<210>   22

<211>   456

<212>   PRT

<213>   Streptomyces lividans

<400>   22

```
Met Asp Pro Ala Ser Gly Val Ile Val Ala Gln Thr Ala Ala Gly Thr
1               5               10              15

Ser Val Val Leu Gly Leu Met Arg Cys Gly Arg Ile Trp Leu Cys Pro
            20              25              30

Val Cys Ala Ala Thr Ile Arg His Lys Arg Ala Glu Glu Ile Thr Ala
            35              40              45

Ala Val Val Glu Trp Ile Lys Arg Gly Gly Thr Ala Tyr Leu Val Thr
    50              55              60

Phe Thr Ala Arg His Gly His Thr Asp Arg Leu Ala Asp Leu Met Asp
65              70              75              80

Ala Leu Gln Gly Thr Arg Lys Thr Pro Asp Ser Pro Arg Arg Pro Gly
            85              90              95

Ala Tyr Gln Arg Leu Ile Thr Gly Gly Thr Trp Ala Gly Arg Arg Ala
            100             105             110

Lys Asp Gly His Arg Ala Ala Asp Arg Glu Gly Ile Arg Asp Arg Ile
            115             120             125

Gly Tyr Val Gly Met Ile Arg Ala Thr Glu Val Thr Val Gly Gln Ile
    130             135             140
```

27

Asn Gly Trp His Pro His Ile His Ala Ile Val Leu Val Gly Gly Arg
145   150   155   160

Thr Glu Gly Glu Arg Ser Ala Lys Gln Ile Val Ala Thr Phe Glu Pro
            165   170   175

Thr Gly Ala Ala Leu Asp Glu Trp Gln Gly His Trp Arg Ser Val Trp
            180   185   190

Thr Ala Ala Leu Arg Lys Val Asn Pro Ala Phe Thr Pro Asp Asp Arg
            195   200   205

His Gly Val Asp Phe Lys Arg Leu Glu Thr Glu Arg Asp Ala Asn Asp
    210   215   220

Leu Ala Glu Tyr Ile Ala Lys Thr Gln Asp Gly Lys Ala Pro Ala Leu
225   230   235   240

Glu Leu Ala Arg Ala Asp Leu Lys Thr Ala Thr Gly Gly Asn Val Ala
            245   250   255

Pro Phe Glu Leu Leu Gly Arg Ile Gly Asp Leu Thr Gly Gly Met Thr
            260   265   270

Glu Asp Asp Ala Ala Gly Val Gly Ser Leu Glu Trp Asn Leu Ser Arg
            275   280   285

Trp His Glu Tyr Glu Arg Ala Thr Arg Gly Arg Arg Ala Ile Glu Trp
    290   295   300

Thr Arg Tyr Leu Arg Gln Met Leu Gly Leu Asp Gly Gly Asp Thr Glu
305   310   315   320

Ala Asp Asp Leu Asp Leu Leu Leu Ala Ala Asp Ala Asp Gly Gly Glu
            325   330   335

Leu Arg Ala Gly Val Ala Val Thr Glu Asp Gly Trp His Ala Val Thr
            340   345   350

Arg Arg Ala Leu Asp Leu Glu Ala Thr Arg Ala Ala Glu Gly Lys Asp
            355   360   365

Gly Asn Glu Asp Pro Ala Ala Val Gly Glu Arg Val Arg Glu Val Leu
    370   375   380

Ala Leu Ala Asp Ala Ala Asp Thr Val Val Val Leu Thr Ala Gly Glu
385   390   395   400

28

```
Val Ala Glu Ala Tyr Ala Asp Met Leu Ala Ala Leu Ala Gln Arg Arg
              405                 410                 415

Glu Glu Ala Thr Ala Arg Arg Arg Arg Glu Gln Asp Asp Asp Gln Asp
              420                 425                 430

Asp Asp Ala Asp Asp Arg Gln Glu Arg Ala Ala Arg His Ile Ala Arg
              435                 440                 445

Leu Ala Ser Gly Pro Thr Ser His
    450                 455


<210>   23

<211>   528

<212>   PRT

<213>   Streptomyces phaeochromogenes


<400>   23

Met Leu Asn Arg Val Ser Gly Ile Asp Ala Cys Gly Gly Cys Gly Arg
1               5                   10                  15

Arg Val Leu Asp Pro Asp Thr Gly Val Ile Tyr Ala Lys Ser Ser Arg
              20                  25                  30

Gly Tyr Val Val Thr Ile Gly Leu Val Arg Cys Gly Arg Ile Trp Phe
        35                  40                  45

Cys Pro Glu Cys Ser Ser Ala Ile Arg Arg Gly Arg Thr Glu Glu Ile
    50                  55                  60

Lys Thr Gly Ala Leu Arg His Leu Ala Ala Gly Gly Thr Leu Ala Val
65                  70                  75                  80

Val Val Leu Thr Ala Arg His Asn Gln Thr Thr Asp Leu Asp Ser Leu
              85                  90                  95

Val Ala Ala Leu Trp Gly Gly Pro Leu Leu Asp Asp Lys Gly Ala Pro
              100                 105                 110

Val Leu Asp Arg Ser Gly Lys Pro Arg Arg Ala Pro Gly Ala Tyr Gln
              115                 120                 125

Arg Met Leu Thr Ala Pro Ala Phe Tyr Gly Arg Pro Glu Ala Arg Arg
        130                 135                 140
```

29

```
Thr Arg Lys Asp Gly Thr Gln Tyr Val Arg Pro Ala Glu Asp Gly Ile
145                 150             155                 160


Arg His Arg Ile Gly Tyr Ile Gly Met Val Arg Ala Ala Glu Val Thr
                165             170             175


Arg Ser Lys Lys Asn Gly Tyr His Pro His Leu Asn Leu Leu Val Phe
                180             185             190


Leu Gly Gly Glu Leu Ser Gly Thr Pro Ala Lys Gly Asp Val Val Gly
                195             200             205


His Phe Glu Pro Ser Glu Thr Asp Leu Gly Asp Trp Glu Asp Trp Leu
    210             215             220


Arg Glu Met Trp Ala Gly Ala Leu Lys Arg Ala Asp Pro Lys Phe Glu
225             230             235             240


Pro Ser Thr Asp Cys Asp Thr Pro Gly Cys Lys Cys Lys Gly Lys Gly
                245             250             255


His Gly Val Met Val Ser Ile Val Arg Ser Ala Asp Asp Val Ala Leu
                260             265             270


Ile Glu Tyr Leu Thr Lys Asn Gln Asp Gly Lys Arg Glu Arg Pro Asp
                275             280             285


Ser Val Asp Gln Asp Leu Glu Ala Ala Gly Ala Ala Ala Met Glu Thr
    290             295             300


Ala Arg Leu Asp Ser Lys Thr Gly Arg Gly Arg Lys Ser Met Thr Pro
305             310             315             320


Phe Gln Ile Leu Tyr Arg Leu Trp Asp Ile Glu Val Ala Gly Leu Asp
                325             330             335


Pro Asp Met Ala Glu Gly Tyr Gly Thr Pro Lys Gln Leu Arg Ala Trp
                340             345             350


Trp Ala Gln Tyr Glu Glu Ala Leu Ala Gly Arg Arg Ala Ile Glu Trp
                355             360             365


Thr Arg Gly Leu Arg Arg His Val Asp Leu Asp Gly Asp Asp Asp Glu
    370             375             380


Glu Thr Asp Leu Gln Tyr Val Tyr Glu Pro Glu Ala Ala Pro Leu Asp
385             390             395             400
```

30

Gly Gly Val Val Leu Thr Ser Asp Ala Met Arg Leu Val Val Gly Ala
            405   410   415

Asp Ala Glu Leu Asp Leu Asp Asp Val Val Arg Ala Glu Ala Tyr Tyr
            420   425   430

Ser Ala Val Asp Val Val Thr Gly Leu Gly Gly Arg Ala Asp His Val
            435   440   445

Arg Val Ala Thr Ala Glu Glu Leu Ala Glu Val Gln Glu Val Leu Phe
            450   455   460

Ala Arg Thr Gln Glu Arg Ala Glu Glu Ser Arg Arg Gln Arg Arg Ile
465   470   475   480

Ala Glu His Glu Ala Glu Gln Ala Ala Ala His Arg Lys Arg Gln Glu
            485   490   495

Leu Ala Arg Cys Leu Gly Leu Leu Val Arg Gln Arg Gly Gly Thr Gln
            500   505   510

Asp Asp Ser Ala Ala Asp Asn Phe Val Ala His Ile His Ala Asn Arg
            515   520   525

<210>   24

<211>   451

<212>   PRT

<213>   Streptomyces nigirifaciens

<400>   24

Met Asp Pro Ala Ser Gly Val Ile Val Ala Gln Thr Ala Ala Gly Thr
1   5   10   15

Ser Val Val Leu Gly Leu Met Arg Cys Gly Arg Ile Trp Leu Cys Pro
            20   25   30

Val Cys Ala Ala Thr Ile Arg His Lys Arg Ala Glu Glu Ile Thr Ala
            35   40   45

Ala Val Val Glu Trp Ile Lys Arg Gly Gly Thr Ala Tyr Leu Val Thr
            50   55   60

Phe Thr Ala Arg His Gly His Thr Asp Arg Leu Ala Asp Leu Met Asp
65   70   75   80

31

```
Ala Leu Gln Gly Thr Arg Lys Thr Ala Asp Ala Pro Arg Arg Pro Gly
                85                      90                  95

Ala Tyr Gln Arg Leu Ile Thr Gly Gly Thr Trp Ala Gly Arg Arg Ala
            100                 105                 110

Lys Asp Gly His Arg Ala Ala Asp Arg Glu Gly Ile Arg Asp Arg Ile
            115                 120                 125

Gly Tyr Val Gly Met Ile Arg Ala Thr Glu Val Thr Val Gly Gln Ile
            130                 135                 140

Asn Gly Trp His Pro His Ile His Ala Ile Val Leu Val Gly Gly Arg
145                 150                 155                 160

Thr Glu Gly Glu Arg Ser Ala Lys Gln Ile Val Gly Thr Phe Glu Pro
                165                 170                 175

Ser Glu Ala Ala Leu Asp Glu Trp Gln Gly Gln Trp Arg Ala Val Trp
            180                 185                 190

Thr Ala Ala Leu Arg Lys Val Asn Pro Gln Phe Thr Pro Asp Asp Arg
            195                 200                 205

His Gly Val Asp Phe Lys Arg Leu Glu Thr Glu Arg Asp Ala Asn Asp
210                 215                 220

Leu Ala Glu Tyr Ile Ala Lys Thr Gln Asp Gly Lys Ala Pro Ala Leu
225                 230                 235                 240

Glu Leu Ala Arg Ala Asp Leu Lys Thr Ala Asn Gly Gly Asn Val Ala
            245                 250                 255

Pro Phe Glu Leu Leu Gly Arg Ile Gly Asp Leu Thr Gly Gly Met Thr
            260                 265                 270

Glu Asp Asp Ala Ala Gly Val Gly Ser Leu Glu Trp Asn Leu Ala Arg
            275                 280                 285

Trp His Glu Tyr Glu Arg Ala Thr Lys Gly Arg Arg Ala Ile Glu Trp
    290                 295                 300

Thr Arg Tyr Leu Arg Gln Met Leu Gly Leu Asp Gly Gly Asp Thr Glu
305                 310                 315                 320

Ala Asp Asp Leu Asp Leu Leu Leu Ala Ala Asp Ala Asp Gly Gly Glu
            325                 330                 335
```

32

```
Leu Arg Ala Gly Val Ala Val Thr Glu Asp Gly Trp His Ala Val Thr
        340                 345             350

Arg Arg Ala Leu Asp Leu Ala Ala Thr Gln Ala Ala Glu Gly Thr Asp
        355             360             365

Gly Asn Thr Asp Pro Ala Ala Met Gly Glu Arg Val Arg Glu Val Leu
    370             375             380

Ala His Ala Asp Ala Ala Asp Ala Val Val Val Leu Thr Ser Gly Glu
385             390             395             400

Val Ala Glu Ala Tyr Ala Asp Met Leu Ala Ala Leu Ala Leu Arg Arg
            405             410             415

Glu Glu Ala Ala Ala Arg Arg Arg Arg Glu Gln Asp Asp Asp Gln Asp
        420             425             430

Asp Asp Ala Asp Asp Arg Gln Glu Arg Ala Ala Arg His Ile Ala Arg
        435             440             445

Leu Arg Asn
    450


<210>  25

<211>  30

<212>  DNA

<213>  Streptomyces lividans


<400>  25
gaggcaaaag cgaacacctt gggaaagaaa                                        30


<210>  26

<211>  30

<212>  DNA

<213>  Streptomyces phaeochromogenes


<400>  26
ctggcaaaaa gggacgccta ggtaaaggtt                                        30
```

<210> 27

<211> 31

<212> DNA

<213> Streptomyces nigirifaciens

<400> 27
gacccaaaac tgtcgcgcct tgggaaagaa a   31

<210> 28

<211> 20

<212> DNA

<213> Primer

<400> 28
atttcgttga acggctcgcc   20

<210> 29

<211> 20

<212> DNA

<213> Primer

<400> 29
cggcaatccg acctctacca   20

<210> 30

<211> 20

<212> DNA

<213> Primer

<400> 30
tgagacgagc cgtcagcctt   20